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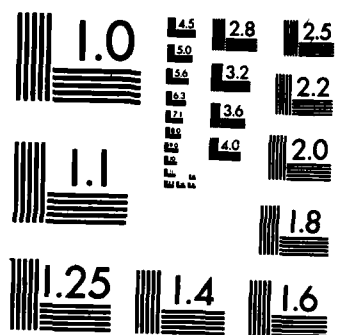UNCLASSIFIED   NPRDC-TN-83-5   F/G 5/9   NL

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VARIABLES PREDICTIVE OF ELIGIBILITY AND REENLISTMENT IN THREE SHIPBOARD RATINGS

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VARIABLES PREDICTIVE OF ELIGIBILITY AND REENLISTMENT
IN THREE SHIPBOARD RATINGS

Ervin W. Curtis

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Reenlistment	Assignments	Ship duty; ship type
Duty stations	Boiler technicians	
Eligibility	Hull maintenance technicians	
Recommendation for reenlistment	Operations specialists	

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Three enlisted ratings (boiler technician, hull maintenance technician, and operations specialist) were analyzed using a little used multivariate technique (THAID). Recommendation for reenlistment of each member and the actual reenlistment/discharge outcome were studied in relationship to a wide range of assignment factors (e.g., durations of assignments, sea vs. shore designations, and ship characteristics). It was found that duration of the first duty assignment was highly correlated with reenlistment. Unauthorized absences and ship type at the first duty station interacted to predict maximally

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recommendation for reenlistment. Sea duty for the last assignment prior to reenlistment/discharge presaged reenlistment, as did being married. Greatly differing probabilities of reenlistment can be obtained by subgrouping potential reenlistees on the basis of the duration of the first duty assignment, sea vs. shore designation of the last assignment, and marital status.

FOREWORD

This work was conducted as in-house independent laboratory research within task area ZR000.01.042.04.03 (Retention of Quality Personnel). The objective of this effort was to identify variables predictive of eligibility and reenlistment in shipboard ratings. Results are intended for use by Navy managers and researchers responsible for developing initiatives and experimental projects for enhancing retention.

JAMES F. KELLY, JR.   JAMES W. TWEEDDALE
Commanding Officer   Technical Director

SUMMARY

Problem

Retention of experienced enlisted personnel in certain Navy occupational specialties has frequently been far below the level needed for top efficiency, effectiveness, and readiness. Too many trained and experienced petty officers have decided not to reenlist. Additionally, those personnel that have been declared ineligible to reenlist have not received adequate research attention. Severe petty officer shortages have resulted. Although reenlistments have increased dramatically in the last 2 years, the shortage is not expected to be eliminated until 1990.

Objective

The purpose of the current research was to analyze the retention and eligibility data for three shipboard ratings, concentrating on previously understudied experiential/assignment variables.

Approach

Historical data from three enlisted ratings (boiler technician, hull technician, and operations specialist) were obtained for all members processed for reenlistment/discharge during 1977-79. For each person, the recommendation for reenlistment and the actual reenlistment/discharge outcome were compared with a wide range of assignment factors (e.g., duration of assignment, sea vs. shore designation, and ship characteristics). The members were subgrouped for maximal differential prediction of recommendation and reenlistment.

Findings

1. The duration of the first duty station assignment was correlated with both recommendation and reenlistment in all three ratings, even though years may have elapsed between the assignment and the date of the recommendation. The longer the assignment, the more likely that the member would be recommended for reenlistment and that he would reenlist.

2. The sea vs. shore designation of the first duty assignment had virtually no correlation with either recommendation or reenlistment. The designation of the last duty station as sea duty was positively related to reenlistment.

3. The number of unauthorized absences and the type of ship for the first duty assignment interacted to maximally predict recommendation for reenlistment in all three of the ratings.

4. The following three variables interacted to maximally predict reenlistment: duration of first duty assignment, sea duty as the last duty assignment, and marital status at the time of reenlistment or discharge.

Conclusions

The duration of the first duty assignment is an important long-range predictor of reenlistment, whereas sea duty is not. Short-term predictors at the last duty assignment include sea duty and marital status. Both lead to a greater percentage reenlisting.

Recommendation for reenlistment can be maximally predicted through the use of the incidence of unauthorized absences and ship classifications. Duration of the first duty assignment is also correlated with this variable.

Recommendations

It is recommended that complete data regarding the first duty station, sea-shore designations, unauthorized absences, and reenlistment eligibility be collected and analyzed for various ship groups in a directed effort to verify the important relationships explored here. It would be especially advisable to reexamine assignment and transfer policies that pertain to the initial assignment following training. It is therefore recommended that critical attention be given to policies, decisions, and conditions that tend to shorten, or make less valuable, the highly formative initial duty assignment.

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INTRODUCTION

Problem

Retention of experienced enlisted personnel in certain Navy occupational specialties has frequently been far below the level needed for top efficiency, effectiveness, and readiness. Too many trained and experienced petty officers have decided not to reenlist. Additionally, those personnel that have been declared ineligible to reenlist have not received adequate research attention. Severe petty officer shortages have resulted. Although reenlistments have increased dramatically in the last 2 years, the shortage is not expected to be eliminated until 1990 (see Figure 1).
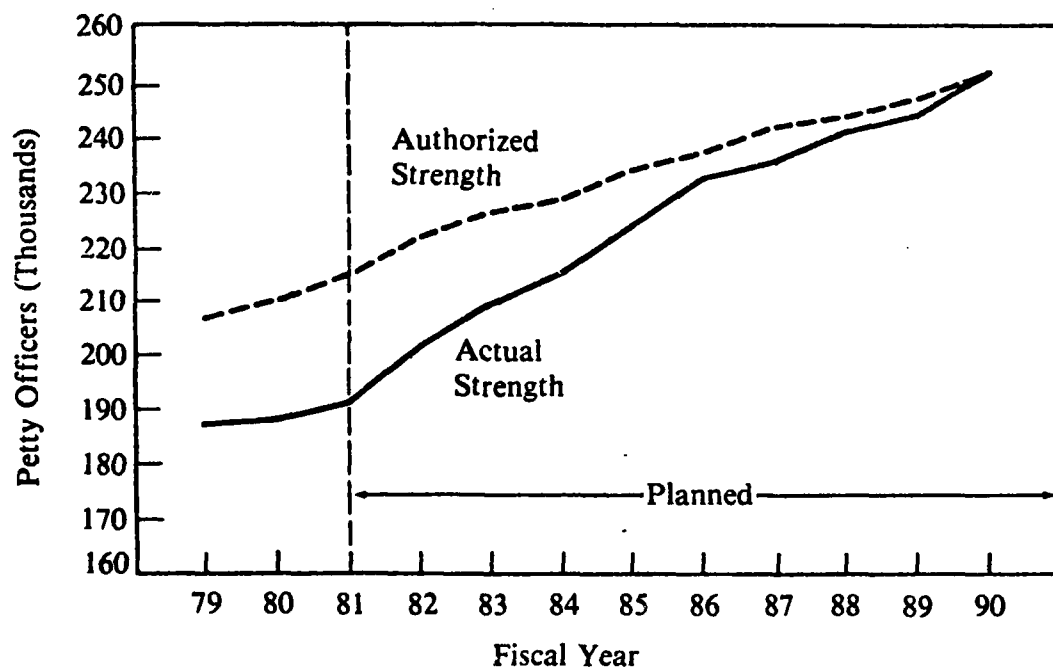
*Grades E-5 to E-9.

Figure 1. Petty officer (E-5 to E-9) shortage. (From Military Manpower Task force: A report to the president on the status and prospects of the all volunteer force. October, 1982.)

Purpose

The purpose of the current research was to analyze the retention and eligibility data for three shipboard ratings, concentrating on previously understudied experiential/assignment variables.

Background

The retention of experienced personnel is a long-standing concern of Navy management and supervisors. Their loss is extremely costly both in terms of recruiting and training replacements and in the lower levels of readiness that result when needed

1

skills and experience are lacking.[1] The Navy has lost great numbers of petty officers to civilian jobs in recent years. All branches of the military have found it difficult to compete with the private sector for trained and experienced personnel. Even the problem of signing up new recruits in this all-volunteer era has been less severe than the problem of keeping trained individuals in uniform. In the mid-1970s, well over half of the Navy's petty officers were signing up for another tour of duty. In 1980 that figure was down to 35 percent, and the Navy was short about 20,000 personnel in the middle-grade skilled jobs. Ships and aircraft squadrons were down to 85 percent of the skilled personnel required for combat readiness.

Another problem that is intertwined with retention is that of eligibility. Personnel who reach the end of their active obligated service cannot reenlist if they are ineligible. Preparing them for eligibility is the responsibility of every command. The discipline, performance standards, rating conversions, etc. that determine eligibility are the direct responsibility of supervisors and commanding officers. The decision to reenlist, on the other hand, is a personal choice that is often beyond the influence of the Navy. Eligibility, therefore, is a major concern and must be studied together with reenlistment in order to understand the overall retention problem.[2]

PROCEDURE

Data Sources

The data used in this study were from two sources:

1. <u>Enlisted master file extract</u>. This data file contains 135 items of information about each enlisted member (e.g., demography, test scores, training, assignments, and performance). An updated version is prepared each month.

2. <u>Enlisted cohort history</u>. This data file, which is maintained by the Naval Health Research Center, contains information similar to that contained in the enlisted master file. This history covers each enlisted member who had been, or still is, on active duty from January 1965 to the current date. It normally tracks a member from date of enlistment to date of discharge.

Three enlisted ratings were studied in this exploratory effort: boiler technician (BT), hull maintenance technician (HT), and operations specialist (OS). They were chosen to represent three occupational fields, respectively: marine engineering, ship maintenance, and ship operations.

Sample

The sample included all male members of the three ratings who had concluded their first enlistment in the 1977-79 timeframe: 5246 BTs, 5040 HTs, and 3479 OSs.

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[1]Office of the Secretary of the Navy. <u>Report of the Secretary of the Navy's task force on Navy/Marine Corps personnel retention</u>. Washington, DC: Department of the Navy, 1966.

[2]Kelly, J. F. Retention: The pressure is on. In <u>Naval Institute Proceedings</u>. Annapolis, MD: Naval Institute, April 1980.

Variables

An attempt was made to obtain the data shown in Table 1 and defined below for all sample members. However, many of the records on the enlisted master file were incomplete (contained blanks). Thus, sample sizes for some of the variables were greatly attenuated.

Table 1

Sample Size by Variable

Variable	Rating		
	BT	HT	OS
1. Recommended/not recommended	5246	5040	3479
2. Reenlisted/discharged	5246	5040	3479
3. "A" school vs. fleet assignment	3925	3671	2803
4. First duty station:			
a. Sea vs. shore designation	696	775	569
b. Type of command	416	517	371
c. Ship group	412	480	361
d. Ship size	409	452	354
e. Ship crowding	403	316	349
f. Duration	114	185	180
5. Assignment pattern	104	117	171
6. Unauthorized absences	5240	5040	3479
7. Performance evaluation	221	435	274
8. Sea time	139	208	196
9. Bad time	3829	4253	3025
10. Last duty station:			
a. Sea vs. shore designation	5244	5037	3479
b. Primary dependents	5230	5018	3479
c. Duration	3621	3386	2630

1. Recommended for reenlistment. Whether or not the qualifications for reenlistment have been met, as attested by the member's commanding officer.

2. Reenlistment. Staying in the Navy beyond the first enlistment period.

3. "A" school vs. fleet. Whether the member attended an "A" school immediately following recruit training.

4. First duty station variables:

a. Sea vs. shore designation. The official designation of the assignment, for rotation, pay, etc. purposes.

b. __Type of command.__ The classification as ship, submarine headquarters/staff, fleet air squadron, support air squadron, fleet training squadron/group/wing, naval air station/facility, or training command.

c. __Ship group.__ The groupings used in this study were loosely based upon tonnage and the Navy's official list of classifications:

(0)　Carriers
(1)　Large amphibious: LCC, LHA, LPH
(2)　Small amphibious: LKA, LP (D, R, A), LS (D, T)
(3)　Frigates and patrol combatants
(4)　Cruisers and guided missile ships
(5)　Destroyers
(6)　Ocean tugs, salvage tugs, and miscellaneous command ships (AGF)
(7)　Tenders and repair ships
(8)　Other small service ships

d. __Ship size.__ The enlisted complement in hundreds.

e. __Ship crowding.__ An index based on the ratio of tonnage to enlisted complement.

f. __Duration.__ The member's length of time at the duty station.

5. __Assignment pattern, in terms of sea, preferred sea, and shore duty.__ The implied desirability of the first and second duty assignments was based on the assumption that regular sea duty, particularly two tours in a row, is undesirable and shore duty is desirable. The following is a listing of possible first and second duty assignments, listed in order of assumed worst/best case.

First Duty Assignment	Second Duty Assignment	Assumed Worst/ Best Case
Sea	Sea	Worst
Sea	Preferred Sea	
Preferred Sea	Sea	
Preferred Sea	Preferred Sea	
Sea	Shore	
Preferred Sea	Shore	
Shore	Preferred Sea	
Shore	Shore	Best

6. __Unauthorized absences (UAs).__ The number of unauthorized absences the member has to his record.

7. __Performance evaluation.__ The first overall evaluation recorded on the member's master tape record.

8. __Sea time.__ The total number of months accrued under the "sea" designation.

9. __Bad time.__ The amount of service time that will not count for pay purposes (e.g., loss time for UA, desertion, etc.).

10. Last duty station variables.

    a. Sea vs. shore designation.

    b. Primary dependents. The number of primary dependents the member had at the end of his first term.

    c. Duration. The member's length of time at the duty station.

Predictive Interaction Analysis

The THAID computer program was used to account for recommendation and reenlistment without the restrictions of linearity, additivity, and homogeneity common to most other multivariate techniques.[3] It is essentially a model-searching procedure intended to be used for exploration prior to the implementation of parameter estimation, significance testing, replication, etc. THAID scans the relationships between a set of predictors and Y, the variable to be predicted, determining the one best predictor and dichotomous partitioning to explain variation on Y. Thus, it splits the sample into two groups that differ maximally on Y. Then it sequentially chooses other predictors and further subgroupings to maximally differentiate the sample members.

RESULTS

Correlational Analysis

Table 2 presents the correlational results for recommendation and reenlistment. In the case of the recommendation for reenlistment, three variables yielded correlations greater than .30 across two or more of the ratings: duration of first duty assignment, assignment pattern, and unauthorized absences. The longer the first assignment and the more desirable the first two duty assignments, the more likely that the member would be recommended for reenlistment. Not surprisingly, those members recommended tend to have fewer unauthorized absences.

Some of the correlations did not reach statistical significance, whereas others did even though smaller. This was due to the missing data problem. Sample sizes were large, which made small correlations for variables with complete data statistically significant. Unfortunately, the other variables were missing in many of the records on the enlisted master tape. For these variables, follow-up collection and analysis of more complete data are planned.

Table 2 also gives the correlations of actual reenlistments with the preselected variables. Again, the duration of the first duty assignment achieved high correlations for all three ratings. This was the only variable with a high correlation to reenlistment, although the following three variables performed consistently well:

1. Sea (vs. shore) designation of last duty station.
2. Duration of assignment at last duty station.
3. Assignment pattern for the first two duty stations.

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[3]Morgan, R. G., & Messinger, R. C. THAID: A sequential analysis program for the analysis of nominal scale dependent variables. Ann Arbor, MI: Institute for Social Research, 1973.

Table 2

Correlates of Recommendation and Reenlistment

Variables 3 through 10	Recommendation (Variable 1)			Reenlistment (Variable 2)		
	BT	HT	OS	BT	HT	OS
3. "A" school vs. fleet after recruit training	.04**	.07**	-.03	.03*	.02	.08*
4. First duty station:						
a. Sea vs. shore designation	.03	.00	-.03	.01	.01	.06
b. Type of command	.05	.12*	-.08	.10	.09	.11
c. Ship group	.13	.14	.13	.19	.14	.22*
d. Ship size	.13	-.16	.14	-.16	-.15	-.23*
e. Ship crowding	-.09	-.16	-.06	.17*	.08	.12*
f. Duration	.61*	.30	.56*	.55*	.39*	.58*
5. Assignment pattern	.35*	.39*	.17	.23	.21	.28
6. Unauthorized absences (UAs)	-.31**	-.32**	-.28**	.17**	.16**	.13**
7. Performance evaluations	.14	.21**	.34**	.11	.15	.18*
8. Sea time	-.24	.10	-.17	.15	-.08	-.18
9. Bad time	.04	-.04*	.03	.05	.06	.08*
10. Last duty station:						
a. Sea vs. shore designation	.09**	.06**	.05**	.30**	.20**	.26**
b. Primary dependents	.07**	.07**	.04*	.10**	.12**	.16**
c. Duration	.13**	.09**	.10**	-.27**	-.22**	-.19**

*p < .05
**p < .01

The assignment pattern variable is of interest even though its correlations (.23, .21, and .28) are not statistically significant. Consistency of correlation across the three ratings is an important statistical consideration when sample sizes are as small as they were in this case. Since the search was for correlations greater than zero in representative shipboard ratings, consistency provides better evidence than statistical signficance would in a one-rating study. Nevertheless, replication of these results within a given rating is needed.

The following variables did not relate to either recommendations or reenlistments:

1. "A" school vs. fleet assignment upon completion of recruit training.
2. Sea vs. shore designation of first duty station.
3. Type of command of first duty station.
4. Bad time.

Multivariate Analysis

Earlier cautionary statements regarding incomplete data and small sample sizes are especially important in interpreting the following data. Multivariate results are especially subject to unreliability. Therefore, replication with more complete data is imperative.

Recommendations for Reenlistments

In terms of the ratings and variables studied, recommendations for reenlistment were largely functions of unauthorized absences (UAs) and the ship group of the first duty station.

1. Boiler technicians (BTs). Figure 2 shows the THAID program analysis for BTs. The total sample for which complete data were available was 265. Eighty-six percent were recommended for reenlistment. The sample was split by THAID into two subsamples on the basis of the strongest predictor, the number of UAs. The "Delta" for the split, which is the statistic used to select the subgroups, was .43. (Delta is analogous to chi square, and indicates the relative strength of the relationship that resulted from the split.) Of the members without UAs, subgroup B, 94 percent were recommended for reenlistement, whereas only 72 percent of the members with UAs, subgroup C, were recommended. Subgroup B was split further into subgroups D and F on the basis of ship group. The factor that gave the largest Delta between members of subgroup C, the group with UAs, was whether they had only one or more than one UA.

2. Hull maintenance technicians (HTs). Figure 3 shows the results of a similar analysis for HTs. In this case, subgroup C was too small to split (N = 37). This yielded three subgroups (D, E, and C) differing greatly in their percentages recommended for reenlistment--97, 90, and 51 percent.

3. Operations specialists (OSs). Figure 4 shows the results of the THAID program analysis for OSs. Again, the splits were on UAs and ship group.

Actual Reenlistments

The results of the THAID program analyses show that being on sea duty and married at the conclusion of one's first enlistment period presaged reenlistment, especially if the first duty assignment had been relatively lengthy (Figures 5, 6, and 7).

1. Boiler technicians (BTs). For BTs, 53 percent of the complete-data sample reenlisted (Figure 5). The first split was on married vs. unmarried; 73 percent of the married members reenlisted vs. only 29 percent of the unmarried members. THAID then determined that the optimum second split for both groups was on length of time spent at the first duty station.
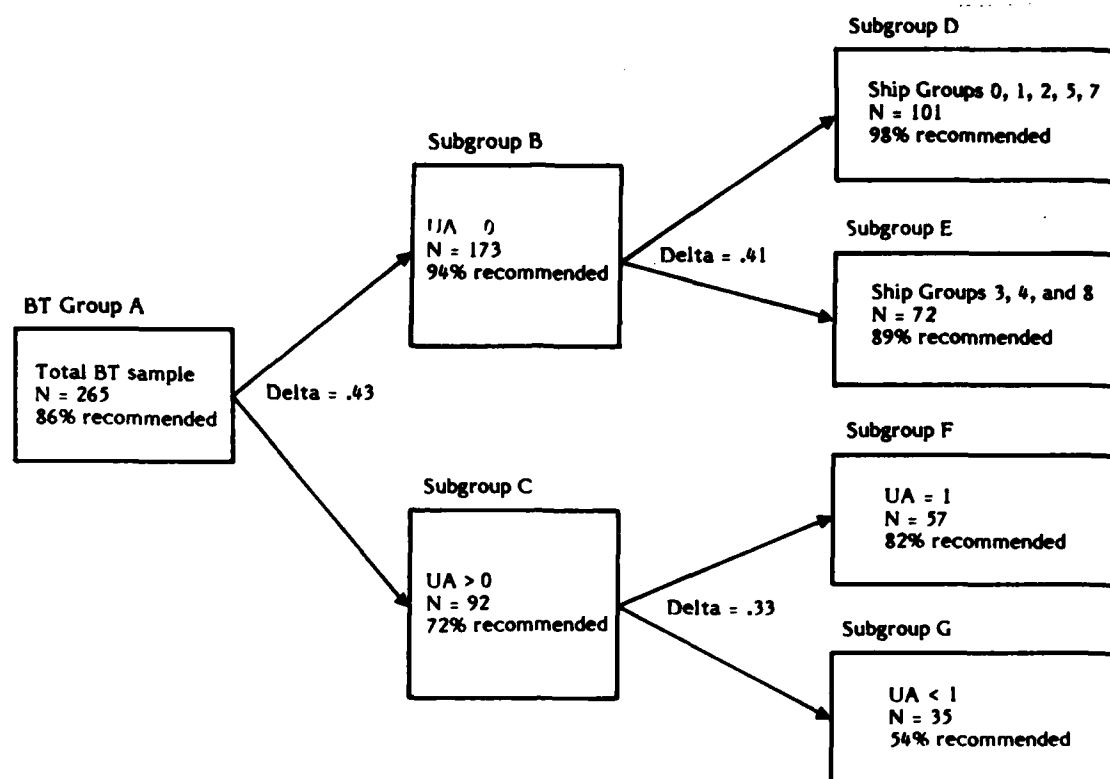
Figure 2. Recommendations for reenlistment of BTs, analyzed by the THAID program.
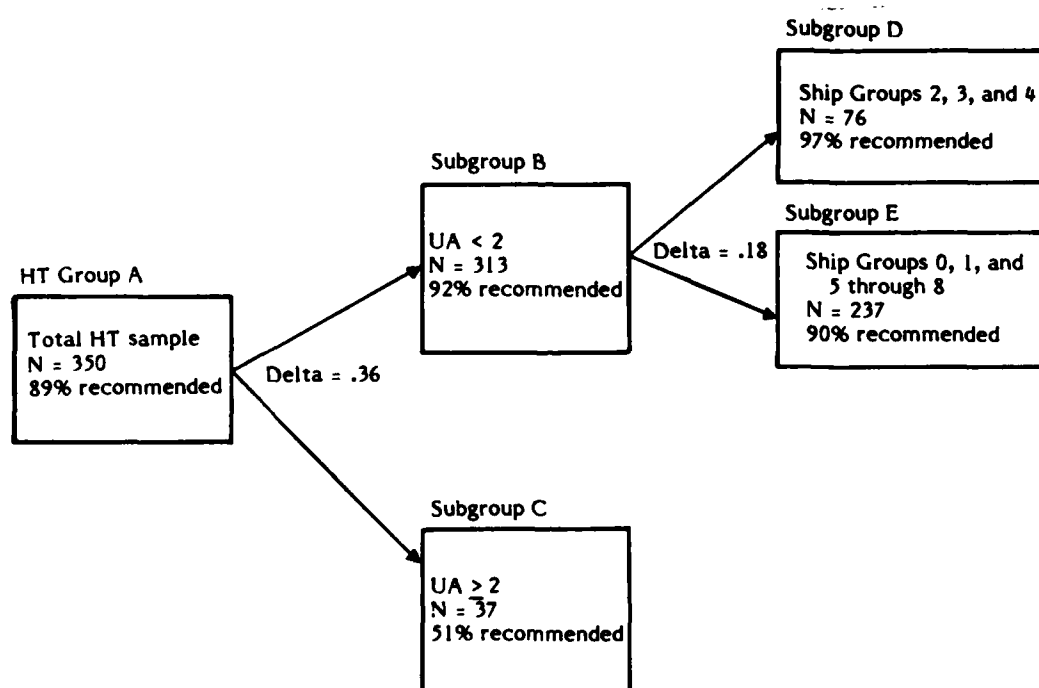

Figure 3. Recommendations for reenlistments of HTs, analyzed by the THAID program.
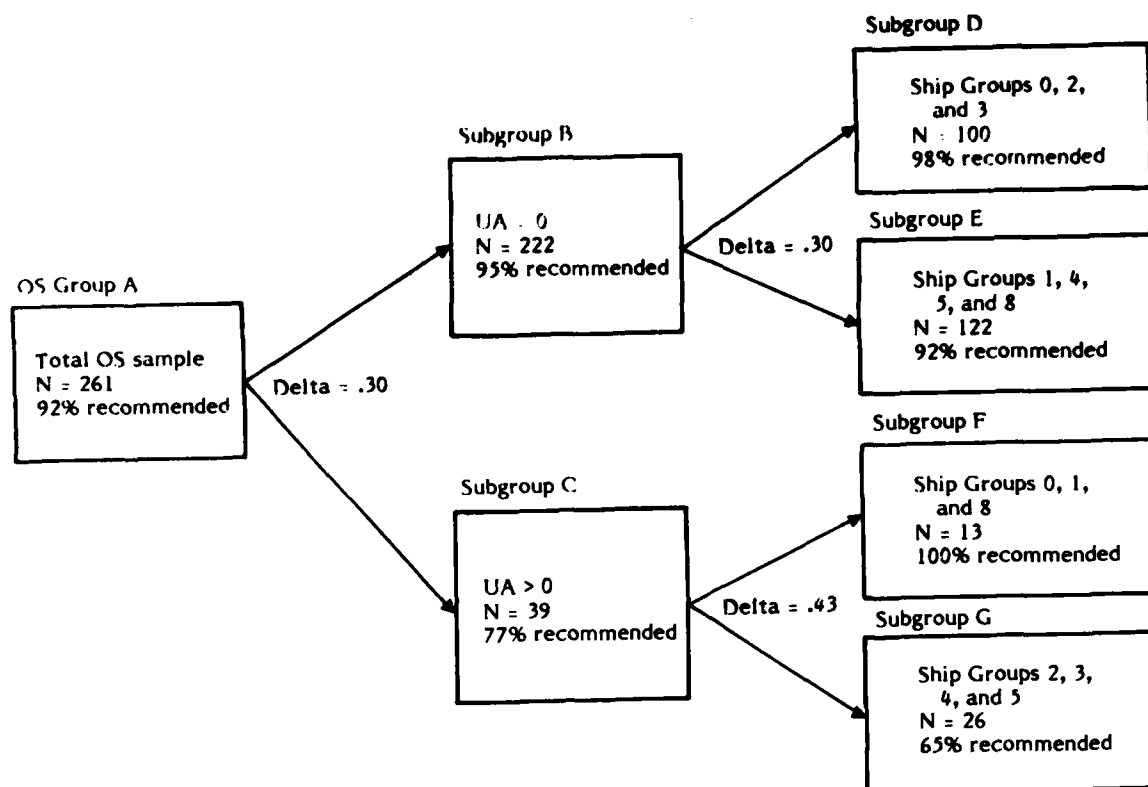
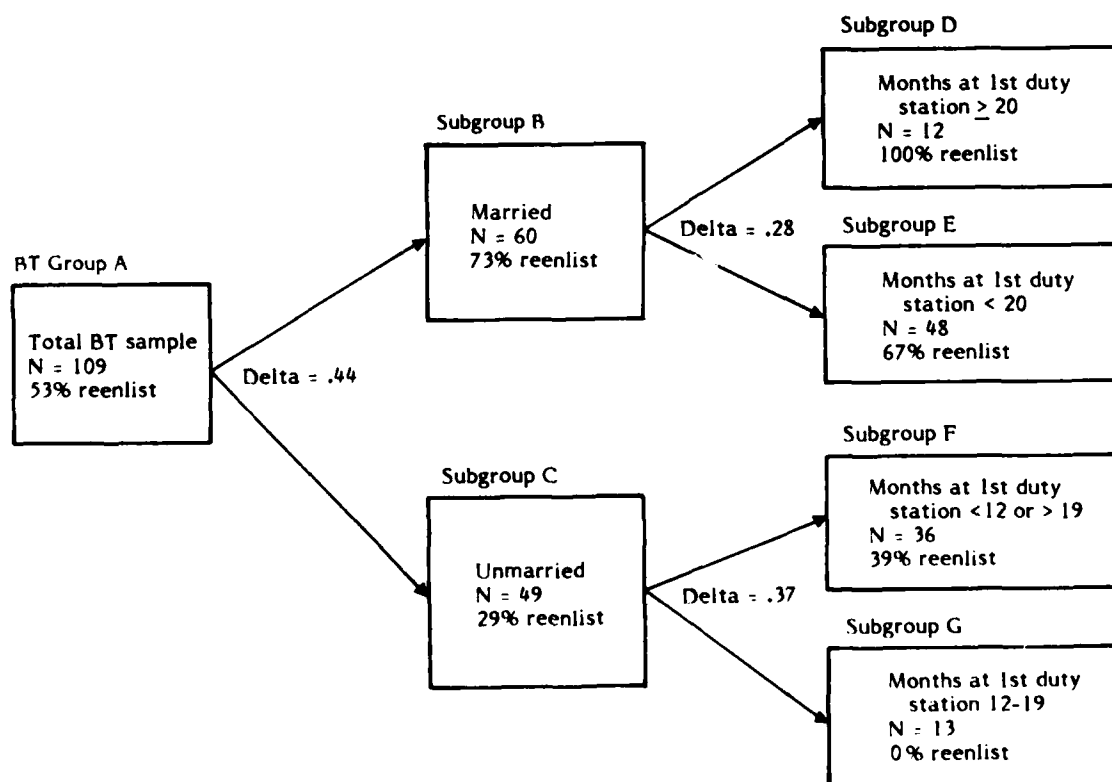Figure 4.   Recommendations for reenlistment of OSs, analyzed by the THAID program.

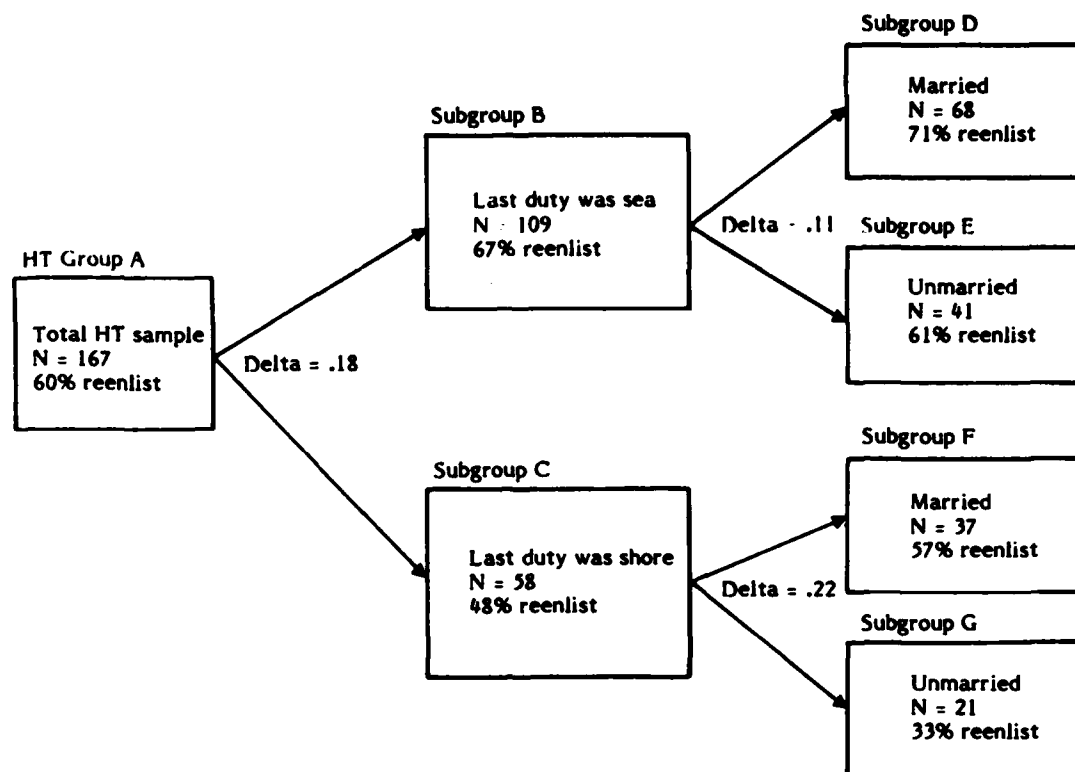Figure 5. Actual reenlistments of BTs, analyzed by the THAID program.

Figure 6. Actual reenlistments of HTs, analyzed by the THAID program.

Subgroup D
Married
N = 68
71% reenlist

Subgroup B
Last duty was sea
N = 109
67% reenlist

HT Group A
Total HT sample
N = 167
60% reenlist

Delta = .18

Delta - .11 **Subgroup E**
Unmarried
N = 41
61% reenlist

Subgroup C
Last duty was shore
N = 58
48% reenlist

Delta = .22

Subgroup F
Married
N = 37
57% reenlist

Subgroup G
Unmarried
N = 21
33% reenlist
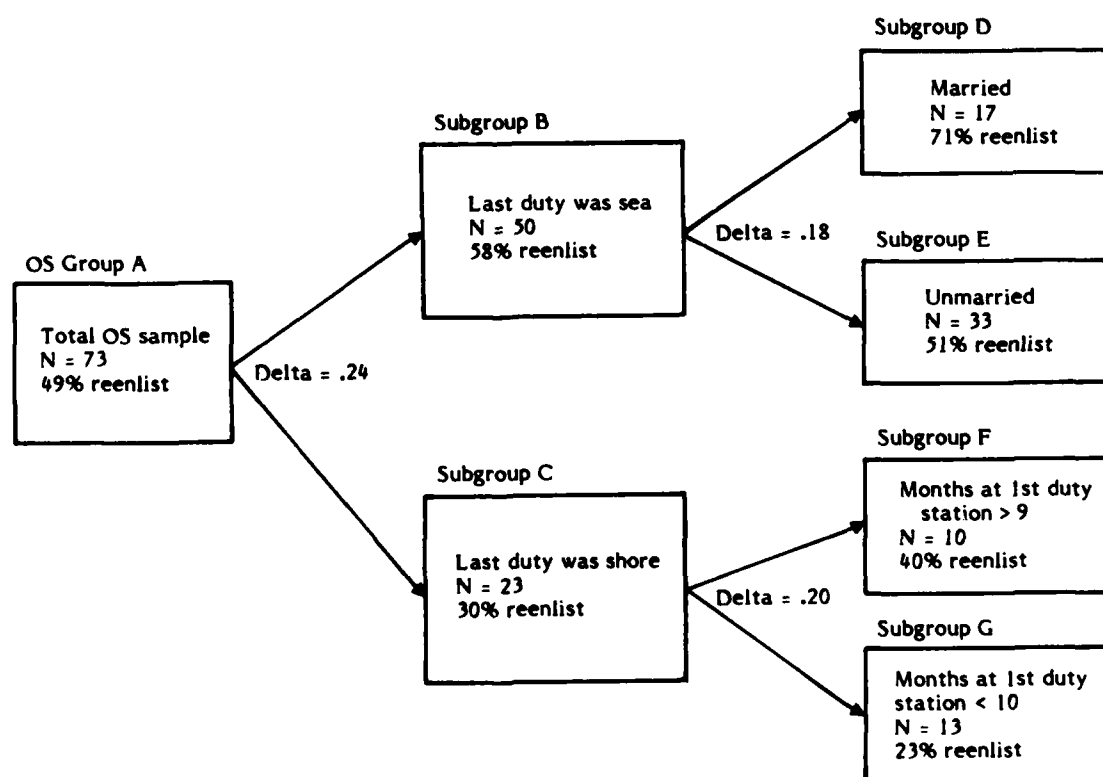
Figure 7. Actual reenlistments of OSs, analyzed by the THAID program.

Subgroup D
Married
N = 17
71% reenlist

Subgroup B
Last duty was sea
N = 50
58% reenlist

OS Group A
Total OS sample
N = 73
49% reenlist

Delta = .24

Delta = .18 **Subgroup E**
Unmarried
N = 33
51% reenlist

Subgroup C
Last duty was shore
N = 23
30% reenlist

Delta = .20

Subgroup F
Months at 1st duty
N = 10
40% reenlist

Subgroup G
Months at 1st duty
station < 10
N = 13
23% reenlist

10

2. <u>Hull maintenance technicians (HTs)</u>. For the HT rating (Figure 6), 60 percent of the sample reenlisted, and the first split was on the sea/shore designation of the last duty station: 67 percent of the members on sea duty reenlisted vs. on 48 percent of the members on shore duty. The optimal second split for both subgroups was on marital status.

3. <u>Operations specialists (OSs)</u>. Very similar results were obtained for the OS rating (Figure 7). The first split was on the sea/shore designation of the last duty station: 58 percent of the members on sea duty reenlisted, vs. only 30 percent of the members on shore duty. The sea members were then split on marital status, and the shore member on length of time at the first duty station.

CONCLUSIONS

Notwithstanding the fact that the above analyses should be extended to additional ratings with more complete data, the following tentative conclusions can be drawn:

1. The duration of the first duty station assignment is a strong predictor of both recommendation and reenlistment. The longer the assignment, the more likely that the member would be recommended for reenlistment and would reenlist. This variable is by far the best predictor of reenlistment that has been discovered, at least as far as the voluminous literature on the subject would indicate. The fact that it was independently discovered for three separate ratings is strong evidence of reliability.

2. The sea vs. shore designation of the last duty station prior to discharge or reenlistment is moderately related to reenlistment. However, the relationship is in the opposite direction of many speculations in the literature on this subject. In all three ratings, sea duty presaged reenlistment.

3. There was virtually no correlation between the sea vs. shore designation of the first duty station and subsequent recommendations for reenlistment or actual reenlistments.

4. The number of UAs a member has and the ship group of the first duty assignment interact to maximally predict recommendation for reenlistment. Although "more UAs" always led to a smaller percentage of recommended, the "best" and "worst" ship group depends on the rating and the number of UAs.

5. The following variables are not promising predictors of either recommendation or reenlistments:

        a.   "A" school vs. fleet assignment.
        b.   First duty station variables:
            (1) Sea vs. shore.
            (2) Type of command.
            (3) Ship size.
            (4) Ship crowding.
        c.   Performance evaluations.
        d.   Amount of sea time.
        e.   Bad time.

6. The following three variables interact to maximally predict reenlistment (greatly differing probabilities of reenlistment can be obtained by subgrouping potential reenlistees on these three variables):

    a. Duration of the first duty assignment.
    b. Sea duty for the last duty assignment.
    c. Married at the time of discharge/reenlistment.

RECOMMENDATION

It is recommended that complete data regarding the first duty station, sea-shore designations, unauthorized absences, and reenlistment eligibility be collected and analyzed for various ship groups in a directed effort to verify the important relationships explored here. It would be especially advisable to reexamine assignment and transfer policies that pertain to the initial assignment following training. It is therefore recommended that critical attention be given to policies, decisions, and conditions that tend to shorten, or make less valuable, the formative first on-the-job assignment.

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